



UNITED STATES PATENT AND TRADEMARK OFFICE

[Handwritten signature]

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,897	01/22/2004	Jay S. Burnham	BUR920030110US1	1896
29625	7590	01/19/2006		
MCGUIRE WOODS LLP 1750 TYSONS BLVD. SUITE 1800 MCLEAN, VA 22102-4215			EXAMINER PRENTY, MARK V	
			ART UNIT 2822	PAPER NUMBER

DATE MAILED: 01/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/707,897	Applicant(s) BURNHAM ET AL.	
	Examiner MARK PRENTY	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on November 2, 2005, and November 4, 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-26 and 31-36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 23 is/are allowed.
- 6) ☒ Claim(s) 14-16, 20, 22, 24-26, 31 and 35 is/are rejected.
- 7) ☒ Claim(s) 17-19, 21, 32-34 and 36 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

This Office Action is in response to the amendment filed on November 2, 2005, and the "supplemental" amendment filed on November 4, 2005.

As a preliminary matter, the Applicants' allegation: "Applicants note that claims 23-26 were not specifically indicated to contain allowable subject matter. However, as these claims were not rejected on the basis of prior art, Applicants are fully justified in believing that these claims contain allowable subject matter. Accordingly, Applicants have herein presented claims 23, 24 and 26 in independent form and request allowance of at least claims 23-26," is unsubstantiated and without merit, at least with respect to claims 24-26, which were and remain rejected under 35 U.S.C. 112, second paragraph. The examiner respectfully notes the Applicants do not provide any support for their allegation that claims not rejected on the basis of prior art contain allowable subject matter. Indeed, the examiner respectfully notes that claims 24-26 were not rejected on the basis of prior art because their indefiniteness precludes an effective comparison with the prior art. In any event, the examiner respectfully submits that the Applicants' presentation of rejected dependent claims 24-26 in independent form does not change their rejected status.

The specification is objected to in that "atoms/cm²" [paragraphs 0036 and 0047] should read, "atoms/cm³," because such is the parameter of the concentration context of those paragraphs (see paragraph [0036], for example, which subsequently discloses "However, other levels of nitrogen concentration may be achieved"). Correction is required (note that the amendment filed on November 2, 2005, made similar corrections

Art Unit: 2822

to paragraphs 0032-0034, 0036, 0046 and 0047, but the "supplemental" amendment filed on November 4, 2005, undid the corrections made to paragraphs 0036 and 0047).

Claim 25 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim contains subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Specifically, amended claim 25's recitation: "wherein the second concentration of nitrogen is added in the amount of about 1×10^{13} to 1×10^{15} atoms/cm²," is new matter, and should be changed back to read, "wherein the second concentration of nitrogen is about 1×10^{13} to 1×10^{15} atoms/cm³," as per the amendment filed on November 2, 2005. In this regard, the applicants' remark: "Support for the amendment to the specification and claim 25 can be found on paragraph [0036] of the specification which explains that nitrogen can be added in the recited amount," is incorrect. Specifically, originally filed paragraph [0036] taken as a whole does not disclose, "that nitrogen can be added in the recited amount." Rather, originally filed paragraph [0036] taken as a whole discloses that nitrogen is added to produce a concentration of 1×10^{13} to 1×10^{15} atoms/cm³, as evidenced by paragraph [0036]'s subsequent disclosure that "other levels of nitrogen concentration...may be achieved." See also claim 25 as originally filed, which recites "the second concentration of nitrogen." Again, claim 25 should be changed back to read, "...wherein the second concentration of nitrogen is about 1×10^{13} to 1×10^{15} atoms/cm³," as per the amendment filed on November 2, 2005.

Claims 24-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, independent claim 24 is indefinite in reciting that the first concentration of nitrogen is "sufficient to prevent appreciable gate leakage and dopant penetration in the first gate dielectric without causing an appreciable threshold-voltage shift in the first gate dielectric." Similarly, independent claim 26 is indefinite in reciting that the second concentration of nitrogen is "sufficient to prevent appreciable gate leakage and dopant penetration in the second gate dielectric without causing an appreciable threshold-voltage shift in the second gate dielectric." Claim 25 depends on claim 24 and is thus similarly indefinite.

Claims 14, 15, 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent 6,538,278 to Chau together with United States Patent 6,853,037 to Kudo et al. (Kudo).

As to independent claim 14, Chau discloses a semiconductor structure (see the entire patent, including the Fig. 2 disclosure) comprising: a semiconductor substrate 202; a first active device 250 formed on the substrate, the first active device having a first gate dielectric 260, which has a first concentration of nitrogen; and a second active device 210 formed on the substrate, the second active device having a second gate dielectric 220, which has a second concentration of nitrogen different than the first concentration of nitrogen.

The difference between claim 14 and Chau is claim 14's second gate dielectric is thicker than its first gate dielectric (Chau's first and second gate dielectrics 260 and 220 apparently have the same thickness).

Kudo teaches forming the gate dielectric of a CMOS device's PMOS transistor thinner than the NMOS transistor's gate dielectric in order to make the operating speed of the PMOS transistor high (see column 1, lines 61-67, for example).

It would have been obvious to one skilled in the art to make Chau's PMOS gate dielectric 260 thinner than NMOS gate dielectric 220 (resulting in NMOS gate dielectric 220 being thicker than PMOS gate dielectric 260) in order to make the operating speed of PMOS transistor 250 high as taught by Kudo.

Claim 14 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chau together with Kudo.

As to dependent claim 15, Chau's first gate dielectric 260 has a first thickness (20-50 Å – see column 5, lines 1-3) susceptible to appreciable dopant diffusion and current leakage (see the specification at paragraph [0028]); and the second gate dielectric 220 has a second thickness (20-50 Å – see column 4, lines 40-42) susceptible to appreciable dopant diffusion and current leakage (see the specification at paragraph [0028]).

Claim 15 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chau together with Kudo.

Art Unit: 2822

As to dependent claim 20, Chau's first thickness (of first gate dielectric 260) and second thickness (of second gate dielectric 220) are less than about fifty angstroms (see column 5, lines 1-3, and column 4, lines 40-42).

Claim 20 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chau together with Kudo.

As to dependent claim 22, Chau's first and second concentrations of nitrogen were selectively introduced by one or more processes including one of: rapid thermal nitridation; furnace nitridation, remote plasma nitridation, decoupled plasma nitridation; well implantation; and polysilicon implantation (see Chau's Fig. 4B and Fig. 4D disclosure).

Claim 22 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chau together with Kudo.

Claims 14-16, 20, 22, 31 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent 6,821,833 to Chou et al. (Chou) together with United States Patent 6,853,037 to Kudo et al. (Kudo).

As to independent claim 14, Chou discloses a semiconductor structure (see the entire patent, including the Fig. 5F disclosure) comprising: a semiconductor substrate 12; a first active device PFET formed on the substrate, the first active device having a first gate dielectric 18B, which has a first concentration of nitrogen; and a second active device NFET formed on the substrate, the second active device having a second gate dielectric 18C, which has a second concentration of nitrogen different than the first concentration of nitrogen (see column 9, lines 43-50, for example).

The difference between claim 14 and Chou is claim 14's second gate dielectric is thicker than its first gate dielectric (Chou's first and second gate dielectrics 18B and 18C apparently have the same thickness).

Kudo teaches forming the gate dielectric of a CMOS device's PMOS transistor thinner than the NMOS transistor's gate dielectric in order to make the operating speed of the PMOS transistor high (see column 1, lines 61-67, for example).

It would have been obvious to one skilled in the art to make Chou's PMOS gate dielectric 18B thinner than NMOS gate dielectric 18C (resulting in NMOS gate dielectric 18C being thicker than PMOS gate dielectric 18B) in order to make the operating speed of the PMOS transistor high as taught by Kudo.

Claim 14 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chou together with Kudo.

As to dependent claim 15, Chou's first gate dielectric 18B has a first thickness (preferably 5-20 Å – see column 7, lines 50-54) susceptible to appreciable dopant diffusion and current leakage (see the specification at paragraph [0028]); and the second gate dielectric 18C has a second thickness (preferably 5-20 Å – see column 7, lines 50-54) susceptible to appreciable dopant diffusion and current leakage (see the specification at paragraph [0028]).

Claim 15 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chou together with Kudo.

As to dependent claim 16, Chou's second concentration of nitrogen (in second gate dielectric 18C) is less than the first concentration of nitrogen (in first gate dielectric 18B). See column 9, lines 43-50, for example.

Claim 16 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chou together with Kudo.

As to dependent claim 20, Chou's first thickness (of first gate dielectric 18B) and second thickness (of second gate dielectric 18C) are less than about fifty angstroms (see column 7, lines 50-54).

Claim 20 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chou together with Kudo.

As to dependent claim 22, Chou's first and second concentrations of nitrogen were selectively introduced by one or more processes including one of: rapid thermal nitridation; furnace nitridation, remote plasma nitridation, decoupled plasma nitridation; well implantation; and polysilicon implantation (see Chau's Fig. 5C and Fig. 5E disclosure).

Claim 22 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chou together with Kudo.

As to dependent claim 31, the obvious Chou/Kudo device's first gate dielectric 18B has a first thickness and its second gate dielectric 18C has a second thickness greater than the first thickness (as per Kudo's teaching), and wherein the second concentration of nitrogen (in second gate dielectric 18C) is less than the first concentration of nitrogen (in first gate dielectric 18B).

Art Unit: 2822

Claim 31 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chou together with Kudo.

As to dependent claim 35, Chou's first and second gate dielectrics are each an oxynitride layer (see column 5, lines 44-47, for example).

Claim 35 is thus rejected under 35 U.S.C. 103(a) as being unpatentable over Chou together with Kudo.

Claims 17-19, 21, 32-34 and 36 are objected to as being dependent upon a rejected base claim, but would be allowable over the prior art of record if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 23 is allowable over the prior art of record.

The applicants' arguments with respect to the maintained rejection of claims 24-26 under 35 U.S.C. 112, second paragraph, are not persuasive.

First, the applicants' argument: "The Examiner quotes certain language of the claims and asserts that the claims are indefinite. Conspicuously absent from the Examiner's assertions, however, is an explanation as to how or why the recited features are indefinite," is not persuasive. The examiner respectfully submits that the quoted claim language, which attempts to define a nitrogen concentration in terms of "appreciable" gate leakage, dopant penetration and threshold-voltage shift, is indefinite on its face.

Furthermore, the applicants' remark: "Applicants note that this feature is discussed in the instant specification on, e.g., paragraph [0025] and is fully supported

Art Unit: 2822

by the disclosure,” is not on point because the cited feature is rejected under 35 U.S.C. 112, second paragraph, not 35 U.S.C. 112, first paragraph.

Furthermore, the applicants’ remark: “Moreover, Applicants have specified examples of concentrations which would produce the results recited in these claims,” is not persuasive because independent claims 24 and 26 do not specifically recite those concentrations, which are not read into the claims.

Finally, the applicants’ remark: “Thus, one having ordinary skill in the art, having read the specification and drawings, would have no difficulty in understanding these claims,” is without merit because limitations from the specification are not read into the claims.

The applicants’ remaining arguments are moot in view of the new grounds of rejection.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Art Unit: 2822

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Registered practitioners can telephone the examiner at (571) 272-1843. Any voicemail message left for the examiner must include the name and registration number of the registered practitioner calling, and the Application/Control (Serial) Number. Technology Center 2800's general telephone number is (571) 272-2800.


Mark V. Prenty
Primary Examiner